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**ATTACHMENT 8: INJECTION WELL PLUGGING PLAN
40 CFR 146.92(b)**

HOOSIER #1 PROJECT

Facility Information

Project Name: Hoosier #1

Facility Name: Cardinal Ethanol

Facility Contact: Jeremey Herlyn, Project Manager
Cardinal Ethanol

Well Location: 1554 N. 600 E.
Union City, IN 47390
CO₂ Injection Well Location for Cardinal CCS1
Latitude 40.186587°
Longitude -84.864284°

Operator Name: One Carbon Partnership, LP
1554 N. 600 E.
Union City, IN 47390

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List of Acronyms

BOP	Blow Out Preventer
CO ₂	Carbon Dioxide
CBL	Cement Bond Log
CCS1	Proposed Injection Well
ft	feet
LD	Lay Down
MIT	Mechanical Integrity Test
ND	Nipple Down
NU	Nipple Up
OPC	One Carbon Partnership, LP
P&A	Plugging and Abandonment
PNL	Pulsed Neutron Log
POOH	Pull out of hole
PU	Pick Up
QASP	Quality Assurance and Surveillance Plan
RAT	Radioactive Tracer Log
RIH	Run in Hole
RU	Rig Up
TD	Total Depth

One Carbon Partnership, LP (OCP) will conduct injection well plugging and abandonment (P&A) according to the procedures below at a time during the project following the cessation of injection that is deemed appropriate.

1 Planned Tests or Measures to Determine Bottom-Hole Reservoir Pressure

Prior to any plugging operations, bottomhole pressure data from the bottomhole gauges set in the Proposed Injection Well (CCS1) will be reviewed. This data will be used to determine an appropriate kill fluid weight.

2 Planned External Mechanical Integrity Test(s)

OCP will conduct at least one of the tests listed in Table 1 to verify external mechanical integrity prior to plugging the injection well as required by 40 CFR 146.92(a).

Following the operations to kill the well, testing of the external mechanical integrity will be performed. This testing will include one or more of the following:

- Temperature Log,
- Radioactive Tracer (RAT) Log,
- Cement Bong Log (CBL),
- Pulsed Neutron Log (PNL).

Prior to any field mobilization or operations, proper notification will be given to the agency. Within this notification, the specific logs and/or tests to be run to determine external mechanical integrity will be provided. The list above is an example of logs that would likely be run to confirm external mechanical integrity and should not be considered to be a comprehensive or final list for this project.

Note the following:

- i. Example procedures for the logging techniques provided above can be found in the Pre-Operational Testing Program or the Testing and Monitoring Plan sections of this application (Attachment 5: Pre-Op Testing Program, 2022) and (Attachment 7: Testing And Monitoring, 2022).
- ii. Specifications on the tools that will be used for this testing can also be found in these same sections or the Quality Assurance Surveillance Plan (QASP) section of this application.
- iii. Criteria for acceptable logging results can be found in the Testing and Monitoring Plan as well as the QASP section of the permit application.

Table 1. Potential MITs for CCS1.

Test Description	Location
Temperature Log	Along wellbore via wireline well log
RAT Log	Along wellbore via wireline well log
CBL	Wireline well log
PNL	Along wellbore via wireline well log

3 Information on Plugs

OCP will use the materials and methods noted in Table 2 to plug the injection well. The volume and depth of the plug or plugs will depend on the final geology and downhole conditions of the well as assessed during construction. The cement(s) formulated for plugging will be compatible with the carbon dioxide (CO₂) stream (Attachment 4: Well Construction, 2022). The cement formulation and required certification documents will be submitted to the agency with the well plugging plan. The owner or operator will report the wet density and will retain duplicate samples of the cement used for each plug.

The general plugging methodology is as follows:

- Sensitive, Confidential, or Privileged Information plugs to be used throughout the well,
- CO₂-resistant cement to be used Sensitive, Confidential, or Privileged Information above the Eau Claire Formation,
- Sensitive, Confidential cement to be used Sensitive, Confidential above the Eau Claire Formation to surface.

Table 2. Plugging details for CCS1.

Plug Information	Plug #1	Plug #2	Plug #3	Plug #4	Plug #5	Plug #6	Plug #7
Diameter of boring in which plug will be placed (in.)	Sensitive, Confidential, or Privileged Information						
Depth to bottom of tubing or drill pipe (ft)							
Sacks of cement to be used (each plug)							
Slurry volume to be pumped (ft ³ , bbl)							
Slurry weight (lb/gal)							
Calculated top of plug (ft)							
Bottom of plug (ft)							
Type of cement or other material							
Method of emplacement (e.g., balance method, retainer method, or two-plug method)							

*EverCRETE CO₂ resistant cement (or an equivalent)
Mark of Schlumberger

4 Narrative Description of Plugging Procedures

4.1 Notifications, Permits, and Inspections

In compliance with 40 CFR 146.92(c), OCP will notify the regulatory agency at least 60 days before plugging the well and provide updated CCS1, if applicable.

4.2 Plugging Procedures

In compliance with 40 CFR 146.92, the following will be done:

1. The regulatory agency will be notified at least 60 days before any field activity begins with an updated plugging plan.
2. Move in the workover rig and rig up (RU) on CCS 1.
3. CO₂ pipelines will be marked and noted with the rig supervisor and facility manager.
4. Hold safety meeting with all available rig crew, contractors and facility personnel.
5. Based on the calculated kill fluid weight needed from the bottom hole pressure survey, kill the well.
 - a. **Sensitive, Confidential, or Privileged Information**
6. Ensure that rig pump or other suitable pump is rigged up to the well. Pressure test all lines to minimum 2,500 psi. Perform annulus pressure test.

7. Fill tubing and cased hole volume with kill brine. Monitor tubing pressure to ensure the well is dead.
8. Once the casing and tubing are dead, nipple down (ND) the well head.
9. Nipple up (NU) and test blow out preventers (BOPs).
10. Latch onto and remove tubing hanger from wellhead.
11. Lay down (LD) tubing hanger.
12. Latch onto injection string.
13. Unlatch from packer
 - a. Note that, at this time, the well is likely to u-tube. Ensure rig pump is connected to the top side, close the BOPs, and slowly circulate out the annulus fluid while maintaining a full column of fluid (as feasible).
14. Pull out of hole (POOH) with tubing and LD same.
 - a. Fill hole as necessary.
15. Pick up (PU) work string with packer pulling tool and run in hole (RIH).
16. Latch onto Packer and remove same.
17. POOH with work string and packer. LD same.
18. RIH with open end work string.
19. Tag bottom. Note tag depth
20. Pump plug #1.
 - a. Pump 20 ft off bottom.
 - b. Sensitive, Confidential, or Privileged Information Plug volume should be as detailed in Table 2.
 - c. Slowly pull out of hole is necessary while pumping plug.
21. Target top of hole should be approximately Sensitive, Confidential. Trip work string out Sensitive, Confidential. Wait at Sensitive, Confidential for approximately two hours.
 - a. Wait time is dependent on hardening time for cement.
 - b. Wet samples of cement should be taken.
22. RIH and tag top of cement. Note top of cement. Ensure cement top has not moved.
23. Repeat steps 20 through 22 plugs 2 and 3.
 - a. Note that cement used in plugs one through three will be CO₂ resistant.
 - b. Target top of plug three to be Sensitive, Confidential. This depth is Sensitive, Confidential, or Privileged Information above the top of the Eau Claire Formation.
24. Flush wellbore with brine.
25. RIH with work string and tag top of cement. Note top of cement.
26. Pump plug # 4.
 - a. Sensitive, Confidential, or Privileged Information
 - b. Target height of plugs should be Sensitive, Confidential. Plug volume should be as detailed in Table 2. Plug to be pumped as balance plug.
 - c. Slowly pull out of hole as necessary while pumping plug.
27. Trip out work string to Sensitive, Confidential above projected top with cement. Wait two hours.
 - a. Wait time is dependent on hardening time for cement.
 - b. Wet samples of cement should be taken.
28. RIH and tag top with cement. Note top of cement
29. Pump remaining 500-foot plugs by repeating steps 34 through 36.
30. Ensure cement is to surface. Fill from surface if necessary.
31. ND BOPs

32. Rig down rig. All casing should be cut to minimum three ft below ground level and have plate with well information welded on top.
33. Fill and level ground as necessary.

Note that the procedure presented above assumes that no contingencies are necessary. Cement volumes, pumping pressures and weights are subject to change based on geologic and field conditions. This plan will be updated following the drilling and completion of CCS1.

All materials and equipment to be used in this procedure are to be cement resistant [REDACTED] above the Eau Claire Formation.

Any contingency plans that are necessary will be provided for as part of the formal procedure submitted 60 days before any field activities.

Following the completion of field activities, a report detailing the procedures and process followed to plug this well will be submitted to the agency. This report will be submitted within 60 days of the completion of plugging.

Figure 1 displays the theoretical plugging schematic for CCS1.

Sensitive, Confidential, or Privileged Information



Figure 1. Injection Well Plugging Schematic

5 References

- (2022). *Attachment 1: Narrative*. Class VI Permit Application Narrative; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 10: ERP*. Emergency And Remedial Response Plan; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 11: QASP*. Project Hoosier#1, Vault 4401.
- (2022). *Attachment 2: AOR and Corrective Action*. Area Of Review And Corrective Action Plan; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 3: Financial Responsibility*. Financial Responsibility; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 4: Well Construction*. Injection Well Construction Plan; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 5: Pre-Op Testing Program*. Pre-Operational Formation Testing Program; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 6: Well Operations*. Well Operation Plan; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 7: Testing And Monitoring*. Testing And Monitoring Plan; Project Hoosier#1, Vault 4401.
- (2022). *Attachment 8: Well Plugging*. Project Hoosier#1, Vault 4401.
- (2022). *Attachment 9: Post-Injection Site Care*. Post-Injection Site Care And Site Closure Plan; Project Hoosier#1, Vault 4401.